

# The Enabling Environment: Global Guidelines and National Policies for Indoor Air Quality

Myles F. Elledge

Indoor air quality (IAQ) is now recognized as a global environmental health hazard, disproportionately affecting the world's poor. The World Health Organization (WHO) reports the following:<sup>1</sup>

- An estimated 3 billion people cook and heat their homes using open fires and stoves burning biomass and coal.
- Nearly 2 million people die prematurely from illness attributable to indoor air pollution (IAP) from solid fuel use.
- Nearly 50 percent of pneumonia deaths among children under 5 are due to particulate matter inhaled from IAP.
- Women and men exposed to heavy indoor smoke are 2 to 3 times more likely to develop chronic obstructive pulmonary disease (COPD).
- Over 1 million people (primarily adults) die each year from COPD that develops because of exposure to IAP.
- Additional suspected health risks include burns, asthma, tuberculosis, cataracts, low birth weight, stillbirth, and cancers, among other risks.<sup>2</sup>

Past cookstove interventions often emphasized energy and environmental concerns. IAQ policy and household energy guidelines are absent in most developing countries, and few prior national cookstove programs and their interventions are equipped to deliver substantial health benefits or to measure health impacts. National IAQ policies and sector guidelines can enable a more integrated approach that places increased emphasis on health, bringing together guidance on fuels, stove technologies, and ventilation, with the goal of improved IAQ.

## Biomass Stove Use

Biomass stoves are a significant contributor to IAP. The use of solid fuels in households in the developing world is most often in traditional fires or inefficient cooking devices. These inefficient stoves placed in poorly vented rooms and buildings produce dangerous levels of IAP. IAP concentrations in developing countries are known to be far above existing WHO

## Summary

### Key Findings

Most national cookstove interventions have emphasized energy and environmental concerns, with modest attention to indoor air quality and the link to health. New WHO guidelines offer health evidence linked to household energy sources and will help drive national indoor air quality policies to bring together energy, health, and environmental resources for cookstove programming.

### Key Policy and Research Recommendations

- National IAQ policies are needed to stimulate advocacy and education programs on IAP.
- Technology development for cleaner cookstoves must include rigorous emission testing to ensure improved stoves are “cleaner” stoves so that health dimensions help set cookstove standards.
- Funding rigorous health studies is important to better understand health outcomes of interventions and to benchmark “how clean is clean.”

air quality guidelines and to be a significant contributor to the burden of disease.

Incomplete combustion of biomass fuels for cooking and heating produces a range of toxic substances harmful to human health. Most important are particulates, carbon monoxide, nitrous oxide, sulfur oxides, formaldehyde, and polycyclic organic matter, which includes carcinogens such as benzopyrene:<sup>3-5</sup>

- Particulates—especially PM<sub>2.5</sub> (particulate matter less than 2.5 micrometers in diameter) and smaller—are extremely hazardous. They can penetrate deep into the lungs and cause bronchial irritation, inflammation, and fibrosis.
- Carbon monoxide binds with hemoglobin to produce carboxyhemoglobin, which reduces the delivery of oxygen to key organs—including in developing fetuses. This may result in low birth weight and increased perinatal deaths.

- Acute exposure to nitrogen dioxide and sulfur dioxide causes acute increases in bronchial reactivity, which causes wheezing and exacerbation of asthma.
- Formaldehyde causes nasopharyngeal and airway irritation, which leads to asthma and increased susceptibility to infections.
- Absorption of toxins in biomass smoke into the lenses of the eyes causes oxidative changes that can lead to cataracts.
- Traditional cooking practices are also a large risk factor for burns and injuries.

### Indoor Air Pollution and Solid Fuel Use (WHO)<sup>1</sup>

- Nearly 3 billion people cook and heat their homes with biomass.
- Exposure to IAP from solid fuels has been linked to acute and chronic diseases.
- An estimated 3 percent of the global burden of disease is the result of burning solid fuels.
- Long-term exposure to IAP may cause cancer and other long-latency diseases.

### Cookstoves as a Multidimensional Issue

The cookstove issue is a multidimensional challenge facing developing countries. The health dimension is significant; cookstoves are linked to more than 2 million premature deaths per year. In many developing countries, women bear the burden of collecting the fuel. Women build the fire and spend many hours a day exposed to emissions as they prepare meals over the cookstove. Serious environmental concerns include cookstoves' major contribution to climate change through the release of greenhouse gases (CO<sub>2</sub>) and short-term climate forcers (black carbon, CO<sub>4</sub>). The unsustainable use of forest products results in erosion and deforestation.

The half dozen national cookstove interventions that exist have placed limited attention on health. Given the burden of disease attributed to IAP, this focus needs to change. Cookstove interventions that integrate energy, climate and environment, livelihood, and health dimensions will be in a position to mobilize more human and financial resources. When health is a defined target of cookstoves programs, the program will have the chance of delivering health benefits.

### Policy Options and Consequences

To date, very few national-scale cookstove programs exist, and global guidance on household energy use in developing countries is lacking. These few national cookstove programs have emphasized energy and the environment as the main program driver. Health dimensions, such as IAQ, have been

underrepresented. Thus, these programs fail to encourage interventions that deliver substantial health benefits.

International development research and multilateral and bilateral global health and environmental programming over the last 30 years tell us that global guidelines can drive national policies and that policies do indeed matter. Access to clean energy at a national scale is an enormous challenge facing cookstove and household energy program initiatives.

- Policies create an enabling environment. Sound policies are critical for replicating and scaling up pilot efforts and are essential in improving access to clean energy that will affect health. Policies can lead to setting regulations and air quality standards or removing tariffs to stimulate trade in cleaner cookstove technology.
- National policies serve as a stimulus for local government or community action to implement IAP education and cookstove interventions, such as healthy kitchen initiatives.
- A national IAQ policy can stimulate national ministries to integrate programs and bring national resources together across energy, environment, climate, and health interests.
- Policies that are strongly supported by government express commitment, articulate priorities, and stimulate the allocation of resources for implementation.
- Policies are important in formulating incentives, such as credits for cookstove manufacturers, financing for carbon offsets, or changes in import restrictions.

### Leading National Cookstove Initiatives

National-scale cookstove programs to date have focused on energy efficiency goals to change household energy use patterns. As of 2011, the leading examples of national cookstove programs were found in Ethiopia, Cambodia, India, Indonesia, Peru, and Mexico.<sup>3</sup> These programs are noted for their national scale and attention to addressing the challenge of providing clean and affordable household energy.

Table 1 presents the characteristics of the leading examples of national-level cookstove programs, identifying institutional leadership, primary drivers, and core program objectives.

These national programs represent these countries' substantial commitment to improve energy efficiency and the health of millions of people who rely on inefficient and highly polluting solid fuels for their household energy. National programs and policies can help countries overcome the many barriers to adopting cleaner cooking practices.<sup>13</sup> However, few are multidimensional, and the countries with the largest IAP public health burden are missing a prominent health objective in their programs.

**Table 1. Leading examples of national-level cookstove programs**

Country	Biomass Use (%)	Dates and Targets	Lead National Institution	Key Program Driver	Objective(s)
Ethiopia <sup>5,6</sup>	95%	2011–2015: 9 million stoves	Ministry of Water and Energy	Energy	Reduce firewood use, create jobs, reduce carbon
Cambodia <sup>7</sup>	91%	1998–2006: 800,000 stoves	Ministry of Industry, Mines & Energy	Environment	Reduce charcoal use, slow deforestation
India <sup>8</sup>	60%	1983–1991: 28 million stoves	Ministry of Non-Conventional Energy Sources	Energy, health	Promote energy efficiency, reduce firewood use
		2009–2019: 15 million stoves	Ministry of New and Renewable Energy	Environment, energy, health	Promote energy efficiency, reduce climate impacts and IAP
Indonesia <sup>9</sup>	48%	2007–2011: 50 million stoves	Ministry of Energy and Mineral Resources	Energy	Stem energy imports
China <sup>10</sup>	48%	1980–1992: 129 million stoves	Ministry of Agriculture	Energy, health	Protect environment, ecology
		1995–2004: No defined target	Ministry of Health	Health	Promote health, reduce environmental risks
Peru <sup>11</sup>	36%	2009–2011: 500,000 stoves	Inter-Ministerial Commission on Social Issues	Environment, energy, health	Promote energy efficiency and health education, reduce climate risks
Mexico <sup>12</sup>	15%	2003–2006: 1,500 stoves	National Forestry Commission	Environment, energy, health	Promote energy efficiency, reduce firewood use, create jobs, promote health education

**WHO Guidelines as Means of Strengthening Health and Other Policy Dimensions**

*WHO Guidelines Will Help.* WHO is preparing new health-based IAQ guidelines for cleaner household energy use. The guidelines will, for the first time, incorporate health information as guidance for fuels and stove technologies and will address issues such as ventilation to reduce IAP. Draft guidelines are being prepared and are expected to be publicly available in 2013. The new IAQ guidelines will establish a compelling health argument for cleaner household energy; further substantiate the link between IAQ and maternal and child health issues, such as pneumonia; and raise awareness of IAQ’s link to noncommunicable diseases in adults. These global efforts, both the guidelines and the associated advocacy, will guide country-level actions and help raise awareness of the importance of cleaner household energy practices as a core preventive public health measure. These guidelines will link air pollution science and policy with household energy policy and programs in developing countries.

The WHO global IAQ guidelines are expected to drive national interventions that target substantial health benefits, linking selected fuels, such as coal or kerosene, with health concerns and describe circumstances in which certain fuels should be avoided

altogether, such as coal (mainly in China) contaminated with arsenic and/or fluorine.

*Integration with New International Organization for Standardization (ISO) Cookstove Emissions Test Standards.* The WHO guidelines will feed into the February 2012 ISO initiative that establishes an international working agreement on the methodology to evaluate the emissions performance of cookstoves. Part of the methodology describes how the proposed emissions standards relate to IAQ and personal exposure levels, with a focus on most-at-risk groups (e.g., pregnant women and young children) at different levels of pollution and exposure, as well as evidence on other major



*Burns and injuries are among the health risks. Children and mothers are most at risk from IAP, as are the aged, who are most often inside the home during cooking. Long-term impacts of IAP are linked to COPD, cancer, and cataracts, among other chronic diseases.*

Photos credits: Myles Elledge and Sumal Nandasena, RTI

health risks (e.g., burns, poisoning, injury). The ISO approach established five tiers of cookstove performance, based on emission rates, along four key performance indicators: fuel use/efficiency, total emissions, indoor emissions, and safety. However, the ISO approach is currently based on emissions characterization, with an approach to estimate the likely reductions in exposure that could result with each higher tier. The WHO guidelines provide the benchmarking needed to transition the ISO approach to a more exposure-based approach, linking it more closely to likely improvements in health.

## Conclusions

WHO's global guidance for IAQ for household fuel consumption is well placed and timely. It will provide the benchmarking needed to help transition the current ISO cookstove working agreement to one more closely linked to actual exposures and health reductions.

The best examples of national cookstove programs are important initiatives, yet few of these initiatives focus on health or outline national policies for IAQ or defined health outcomes.

- WHO guidelines offer health evidence linked to household energy sources. This advice to countries will encourage new and expanded interventions.
- National IAQ policies can power integrated programs to bring together energy, health, and environmental resources.<sup>14</sup>
- Stronger policy and regulatory frameworks will help spur public, private, and nongovernmental organization investment in clean(er) household energy.

## References

- 1 Indoor air pollution and health (Fact sheet 292) [Internet]. Geneva (Switzerland): World Health Organization; 2011 [cited 2012 Aug 30]. Available from: <http://www.who.int/mediacentre/factsheets/fs292/en/>
- 2 Martin WJ 2nd, Glass RI, Balbus JM, Collins FS. A major environmental cause of death. *Science*. 2011 Oct 14;334(6053): 180-1.
- 3 Igniting change: a strategy for universal adoption of clean cookstoves and fuels (Fact sheet) [Internet]. Washington: Global Alliance for Clean Cookstoves; 2011 [cited 2012 Aug 30]. Available from: <http://www.cleancookstoves.org/resources/fact-sheets/igniting-change.pdf>
- 4 Millennium development goals database [Internet]. Washington: United Nations Statistics Division; 2011 Aug 29 [cited 2012 Aug 30]. Available from: <http://data.un.org/Data.aspx?d=MDG&f=seriesRowID%3A712>
- 5 Clean Cook Stove Programme Ethiopia [Internet]. SNV Ethiopia; 2011 [cited 2012 Aug 30]. Available from: <https://sites.google.com/site/ethiopiaccs/>
- 6 Ethiopia launches the roll out of national investment plan under its climate resilient green economy strategy [Internet]. Addis Ababa (Ethiopia): United Nations Development Program Ethiopia. 2012 Apr 19 [cited 2012 Aug 30]. Available from: [http://www.et.undp.org/index.php?option=com\\_news&id=143](http://www.et.undp.org/index.php?option=com_news&id=143)
- 7 Household cookstoves, environment, health, and climate change: a new look at an old problem [Internet]. Washington: World Bank; 2011 [cited 2012 Aug 30]. Available from: <http://climatechange.worldbank.org/sites/default/files/documents/Household%20Cookstoves-web.pdf>
- 8 National biomass cookstoves initiative [Internet]. New Delhi: Government of India, Ministry of New and Renewable Energy; 2009 [cited 2012 Aug 30]. Available from: <http://www.mnre.gov.in/schemes/decentralized-systems/national-biomass-cookstoves-initiative/>
- 9 Budya H, Arofat MY. Providing cleaner energy access in Indonesia through the mega-project of kerosene conversion to LPG. *Energy Policy*. 2011;2:7575-86.
- 10 Qiu D, Gu S, Catania P, Huang K. Diffusion of improved biomass stoves in China. *Energy Policy*. 1996;24(5):463-9.
- 11 Millón de cocinas mejoradas por un Perú sin humo (Half million improved stoves for a smokeless Peru) [Internet]. Lima: Government of Peru; [cited 2012 Mar]. Available from: <http://www.cocinasmejoradasperu.org.pe/>
- 12 Masera OR, Diaz R, Berrueta V. From cookstoves to cooking systems: the integrated program on sustainable household energy use in Mexico. *Energy for Sustainable Development*. 2005;9(1):25-36.
- 13 Bruce N, Rehfuess E, Mehta S, Hutton G, Smith K. Disease control priorities in developing countries [Internet]. 2nd ed. Washington (DC): World Bank; 2006. Chapter 42, Disease control priorities project; [cited 2012 Aug 30]; p. 783-815. Available from: <http://files.dcp2.org/pdf/DCP/DCP.pdf>
- 14 Elledge M, Nandasena S, Phillips MJ, Thornburg VE. Environmental health risk and the use of biomass stoves in Sri Lanka. Research Triangle Park (NC): RTI Press; 2012. Research brief RB-0001-1010. doi:10.3768/rtipress.2010.RB.0001.1010

---

## About the Author

**Myles F. Elledge**, MPIA (Master of Public and International Affairs), is a senior director in the International Development Group at RTI International.

---

RTI Press Research Briefs and Policy Briefs are scholarly essays on policy, methods, or other topics relevant to RTI areas of research or technical focus.

RTI International, 3040 East Cornwallis Road, PO Box 12194  
Research Triangle Park, NC 27709-2194 USA

919.541.6000      [rtipress@rti.org](mailto:rtipress@rti.org)      [www.rti.org](http://www.rti.org)

©2012 Research Triangle Institute. RTI International is a trade name of Research Triangle Institute.

All rights reserved. This brief is protected by copyright. Credit must be provided to the author and source of the document when the content is quoted. Neither the document nor partial or entire reproductions may be sold without prior written permission from the publisher.

RTI Press publication PB-0003-1212

doi:10.3768/rtipress.2012.pb.0003.1212

[www.rti.org/rtipress](http://www.rti.org/rtipress)